National Aeronautics and Space Administration

Economic Impact Report 2016

NASA SBIR/STTR Programs

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The National Aeronautics and Space Administration's (NASA) Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs are highly competitive early-stage award programs, which provide qualified small business concerns (SBCs) with opportunities to propose and develop innovative ideas that meet the specific research and development needs of the Federal Government and have strong potential for commercialization. Specific technological research areas funded typically address the future mission needs of NASA's Mission Directorates – Science, Aeronautics Research, Human Exploration and Operations, and Space Technology.

This study estimates the national economic and fiscal impact generated by NASA's SBIR/STTR programs using the standard practice of input-output modeling. The time frame covered for this analysis was the fiscal year ending in September 2015. For purposes of this study, NASA's SBIR and STTR programs' economic impact derives from the annual research and development operations, which was undertaken by the programs' small business concerns during the fiscal year. In total, NASA SBIR and STTR small businesses received a total of $174.21 million ($152.10 million allocated to SBIR participating small businesses and $22.11 million allocated to STTR participating small businesses) for the development of R&D technologies.

$174.21 Million in SBIR & STTR Awards

In 2013, NASA received approval from SBA to initiate a Commercialization Readiness Program (CRP), as authorized in Section 5123 of P.L. 112-81. The objective of the CRP is an infusion into a NASA application or a commercialization to industry, not an incremental improvement in technology readiness level alone. Technology maturation without infusion or commercialization is not in the scope of the CRP. The CRP is intended to provide the bridge to infusion and commercialization for technologies which could not accomplish this within other funding opportunities. The NASA CRP operates as a matching funding arrangement, with a 1:1 ratio target (SBIR/STTR to non-SBIR/STTR funds). In FY2015, NASA's SBIR and STTR programs funded $6.36 million in CRP awards.

$6.36 Million in CRP Awards

Table 1 - NASA SBIR and STTR Obligated Funding for FY2015

Program	Obligated Funding
SBIR	$152.10 Million
STTR	$22.11 Million
CRP	$6.36 Million
TOTAL	$180.57 Million

Executive Summary

Economic and Fiscal Impact

The investments and subsequent economic and fiscal impact of the STTR and SBIR Programs propagate through-out the United States. While small businesses from 39 states (including Washington D.C.) received awards, the economic effects occurred nation-wide, as supplier and income effects also occur in states in which no small businesses received awards. The economic and fiscal impact stemming from the program's investments are listed in the table below.

Table 2 - Total Economic and Fiscal Impact of NASA SBIR and STTR Obligated Funding

	SBIR	STTR	CRP	Total
Total Investment ($Millions)	$152.10	$22.11	$6.36	$180.57
Total Economic Impact				
Employment (jobs)	2,175	316	91	2,582
Labor Income ($Millions)	$144.96	$21.08	$6.06	$172.10
Value Added ($Millions)	$221.95	$32.27	$9.28	$263.50
Output ($Millions)	$399.64	$58.11	$16.71	$474.46
Total Fiscal Impact				
Total Taxes ($Millions)	$46.27	$6.73	$1.93	$54.93
Federal ($Millions)	$32.18	$2.05	$1.34	$35.57
State and Local ($Millions)	$14.09	$4.68	$0.59	$19.36

NASA's SBIR and STTR programs plays an important role not only within the Nation's research and development sector but the economy as a whole. In total, $180.57 million in NASA SBIR and STTR funds supported the creation of approximately 2,175 American jobs, $172.10 million in additional wages, and $474.46 million in Gross Domestic Product (GDP). The programs generated $54.93 million of annual total tax revenue for the country in FY2015. SBIR/STTR awards contributed $35.57 million in federal taxes and $19.36 million in state and local taxes.

Scope of Work

As established by Section 9 of the Small Business Act (15 U.S.C. 638), as amended by the SBIR/STTR Reauthorization Act of 2011, the SBIR/STTR programs of all eligible agencies shall develop metrics to evaluate the effectiveness, and the benefit to the people of the United States, of the SBIR program and the STTR program of the Federal agency that

a) are science-based and statistically driven;

b) reflect the mission of the Federal agency; and

c) include factors relating to the economic impact of the programs.

Recognizing the importance placed upon the effective evaluation of the programs' benefit to the American people, this analysis is the first step in creating a science-based and statistically driven estimate of the economic impact of NASA's SBIR and STTR programs. Specifically, this analysis calculates the impacts of the program's operations within the United States for the fiscal year 2015.

The introduction describes the study's methodology, detailing the general concept of input-output modeling, the IMPLAN model in particular, and establishing the science-based and statistically driven framework of the analysis. The introduction also contains a short narrative that describes the use of input-output modeling at the federal, state, and local level. Following, the study details awards of NASA SBIR and STTR programs and the economic activities undertaken by the program's awardees. The study calculates the increase in participating firm revenues as a result of receiving NASA SBIR and STTR awards and utilizing this data, the programs' total economic and fiscal impacts are estimated. The total economic impacts, including employment, labor income, and output, are disaggregated by industry sector. To provide a visual interpretation of NASA's SBIR and STTR investments, the study maps the location of program awardees and the amount of federal investment by state.

Methodology and the IMPLAN Model

The theoretical underpinnings of input-output modeling are based upon the notion of inter-industry transactions: industries use the products of other industries to produce their own products. This approach allows one to estimate the number goods and services from other sectors (input) that are required to produce goods and services in the sector of analysis (output). The combined affect across all sectors can be summed to calculate a total economic impact. Input-output modeling is widely used by the various levels of Government to estimate the regional economic impacts of changes in government expenditures, private enterprise, and individual consumption choices. Input-output modeling enables decision-making processes within Government to more fully understand the economic effects (in terms of jobs, output, earnings and taxes) and optimize policy response accordingly.

This analysis utilizes NASA SBIR and STTR obligated funding data, as reported to the Small Business Administration (SBA), in NASA's FY2015 annual report as the basis of the analysis. $180.57 million in agency obligated funds were transformed into employment financial equivalents (jobs) using U.S. Economic Census data for NAICS 541712 [Research and development in the physical, engineering, and life sciences (except biotechnology)]. This transformation ensures precise modeling because NAICS 541712 more accurately represents NASA SBIR and STTR participating firms' economic activity and basic characteristics.[1]

Converted employment financial equivalent figures were used as an input and modeled using MIG, Inc.'s IMPLAN software.[2] 1he IMPLAN model is a robust, industry-standard input-output model that provides insight into economic impacts at different levels of the economy: from the national level down to the ZIP code level. The IMPLAN model is based on the input-output data from the U.S. National Income and Product Accounts from the Bureau of Economic Analysis. The model contains 536 industry sectors that are based on the North American Industry Classification Systems (NAICS). Its framework is considered static because the impacts calculated for any scenario by the model are estimates of the indirect and induced impacts for a one-year time period. For application to the NASA SBIR/STTR Program, the IMPLAN model was calibrated at a national level and all economic activity was modeled under IMPLAN sector 456. No additional changes were made to the IMPLAN model. All dollar values are displayed in 2015 dollars, consistent with the year of program operations studied in this analysis.

The IMPLAN model contains two components: the descriptive model and the predictive model. The descriptive model maps the economy within the region of analysis using a series of accounting tables that trace flows of funds (dollars) between purchasers and producers in the defined region. The model also captures region's movement of exported and imported goods and services. The descriptive models also includes IMPLAN's Social Accounting Matrices (SAM), which define the flow of funds between institutions — such as transfer payments form governments to businesses and households and taxes paid by households and businesses to governments.

The predictive model contains a set of multipliers that can be used to analyze the changes in final demand and their subsequent ripple effects throughout the region of analysis. These ripple effects are often larger than the initial effect as recipients of the initial payments spend a portion of the funds, and the recipients of the new funds spend a portion of the funds as well, and so on and so forth. These effects are reported in terms of value added to the economy (GDP), jobs, and tax revenue. All employment figures estimated through the IMPLAN model include all full-time, part time, and temporary positions.[3] Similar input-output models include the Bureau of Economic Analysis's (BEA) RIMS II model as well as various proprietary models such as REMI, EMSI and REDYN. While each model has its own unique aspects, the theoretical underpinnings are shared and thus the modeling results are comparable.

Government Uses of I-O Modeling

Specific to the federal level, agencies utilize input-output analysis in assessing the economic potential of scientific and social programs, military and other installations, budget adjustments, as well as infrastructure and other development projects. Some examples of federal uses of input-out modeling include:

- The Department of Defense (DoD) uses various input-out models to assess the economic impacts of large scale budgetary decisions, such as the effects of the 2012 sequestration.[4] The DoD also calculates the effect of smaller regional budgetary decisions, such as the closure of Hill Air Force Base in the State of Utah.[5]

- The Department of Transportation utilizes input-output analysis to further inform their decision making process when deciding which projects to undertake, in compliment to Benefits Cost Analysis.[6] The agency also encourages state and local agencies to utilize similar methodologies when pursing local projects as well.

- The Department of Interior calculates the entire agency's annual economic impact. In 2009, their analysis concluded that the agency supports over 1.4 million jobs for Americans and over $370 billion in economic activity.[7]

- In 2010, the U.S. Department of Agriculture calculated that, given an increase of $1 billion dollars in expenditures, the Supplemental Nutrition Assistance Program (SNAP, formerly the Food Stamp Program) is estimated to increase economic activity (GDP) by $1.79 billion and generate approximately 13,500 jobs. This analysis further codified previous estimates from 2002, which suggested a $1 billion increase in spending generated $1.84 billion in economic activity.

1 Firms in NAICS 541712 are limited in size to 500 employees and are engaged primarily in research and development activities relating too physical, engineering, and life sciences (except Biotechnology). Firms within more broad NAICS categories have differing size limits and may be primarily engaged in research areas not applicable to NASA's SBIR and STTR programs, (such as social science, humanities, and biotechnology).

2 IMPLAN was originally developed in 1979 by a joint effort between U.S. Forest Service, the Federal Emergency Management Agency, and the U.S. Department of the Interior's Bureau of Land Management with the goal of assisting in land and resource management planning. The model is used by additional government agencies to quantify various economic activities. For more details see: Miller, Ronald E., and Peter D. Blair. Input-output Analysis: Foundations and Extensions. Englewood Cliffs, NJ: Prentice-Hall, 1985.

3 IMPLAN Pro User GuideD. Blair. Input-output Analysis: Foundations and Extensions. Englewood Cliffs, NJ: Prentice-Hall, 1985.

4 Levine, Linda. N.p., 1 Oct. 2012. Web. 26 Jan. 2013.http://journalistsresource.org/wp-content/uploads/ 2012/10/R42763.pdf

5 Utah Defense Alliance. Jan E. Crispin-Little, Pamela S. Perlich. N.p .. Web. 26 Jun 2013. http://www.bebr. utah.edu/Documents/studies/HAFB04.pdf.

6 United States. Department of Transportation. Office of Asset Management {HIAM).Economic Analysis Primer. N.p., n.d. Web. 26 Jun 2013. http://www.fhwa.dot.gov/infrastructure/asstmgmt/primer.pdf.

7 United States. Department of Interior. Salazar, K.. N.p .. Web. 26 Jun 2013. http://www.doi.gov/news/pressreleases/upload/DO I

The Environment Protection Agency encourages States to assess their own clean energy initiatives using input-output modeling.[8] State and Local governments use of input-output models is as varied as the Federal Government's use of the methodology, and includes:

- State tourism boards - such as the Hawaii Tourism Authority - use various visitor spending surveys combined with input-output analysis to calculate the effect of tourism within state or regional economies.[9] Because tourist expenditures are made by out-of-region consumers, theoretical questions regarding displaced demand and "crowding out" effects can be ignored- thus making economic impact analysis transparent to these factors.

- Regional development agencies and municipalities use input-output studies to estimate employment and tax benefits associated with the opening of national chain retail operations such as a Walmart in Bennington, Vermont.[10]

- Cities also utilize input-out studies to determine the costs and benefits of public-private projects, such as sporting stadiums and arenas. In a recent example, input-output modeling was used to calculate a negative economic impact of building a proposed baseball stadium in Portland, Oregon.[11]

Limitations

The economic and fiscal impacts calculated in this study are attributable to NASA's SBIR and STIR award funding for FY2015, i.e. the directly measurable economic impacts associated with approximately $158.48 million worth of aerospace research and development contracts awarded by NASA. This study does not attempt to estimate the additional positive indirect economic and fiscal impacts of technical innovations developed by the program, nor does this study attempt to estimate the additional economic and fiscal impacts that can be attributed to SBIR and STTR award participants because of their participation with the program. These additional economic and fiscal impacts which occur at the firm level, such as future sales of newly developed innovations, the increase in future government contracts, increased outside investment, new product lines, and other business expansion are difficult to fully capture[12] but are thought to be significant. NASA's SBIR and STTR programs anticipate conducting future research in the form of case studies and longitudinal firm performance studies in order to more fully capture and quantify these indirectly measurable economic effects.

Program Overview

NASA considers technological innovation to be vital to the performance of the NASA mission and to the Nation's prosperity and security. The agency views the NASA SBIR and STTR programs as an integral tool to realizing both the agency's and nation's technological innovation goals. The purpose of the SBIR and STTR programs, as established by law[13], is to stimulate technological innovation in the private

8 "Quantifying Economic Benefits State and Local US EPA." EPA. Environmental Protection Agency, n.d. Web. 26 June 2013.http://www.epa.gov/statelocalclimate/state/activities/quantifying-econ.htmb.

9 "2011 Annual Visitor Research Report." 2011 Annual Visitor Research Report- Hawaii Tourism Authority. Hawaii Tourism Authority, 1 Jan. 2012. Web. 07 July 2013. http://www.hawaiitourismauthority.org/default/assets/ File/reports/visitor-statistics/2011%20Annual%20Visitor%20Research%20Report(2).pdf.

10 "Regional Economic Impact Analysis Associated with Proposed Wal-Mart Expansion in Bennington, Vermont." Institute for Local Self-Reliance. N.p., Dec. 2007. Web. 17 July 2013. <www.ilsr.org/wp-content/uploads/files/Benningtoneis_0.pdf>

11 Pozdena, Randall, Abe Farkas, and Nick Popenuk. "ECONOMIC IMPACT OF PROPOSED BASEBALL STADIUM." Portland Mercury. N.p., 12 May 209. Web. 17 July 2013. <http://www.portlandmercury.com/images/blogimages/2009/05/26/1243382083-lents_stadium_jobs.pdf>.
D. Blair. Input-output Analysis: Foundations and Extensions. Englewood Cliffs, NJ: Prentice-Hall, 1985.

12 Godin, Benoit, and Christian Dore. "Measuring the Impacts of Science: Beyond the Economic Dimension." (n.d.): n. pag. Canadian Social Sciences and Humanities Research Council (SSHRC), 2000. Web. <http://www.csiic. ca/PDF/Godin Dore Impacts.pdf>.

Introduction

sector; to strengthen the role of SBCs in meeting Federal research and development needs; to increase the commercial application of the research results of the programs; and to encourage participation of socially and economically disadvantaged persons and women owned small businesses.

NASA's SBIR program is the third largest of the 11 participating federal agencies. NASA awards SBIR contracts in three phases. A Phase I award is largely a feasibility analysis which is used to determine the commercial merit and technical feasibility of an innovation; a follow-on Phase II award is for continued development, demonstration and delivery of the innovation with post Phase II options providing additional time and funding; a subsequent Phase III award is for the commercialization and transition of the innovation into a NASA mission or marketplace.

NASA's STTR program operates in much of the same vein. The primary characteristic that distinguishes the STTR program from the SBIR program is that STTRs require the SBC to partner with a non-profit organization or a university in order to mature and commercialize the innovation. The competitive nature of the programs ensure that only the most promising of proposals, with the highest likelihood of potential innovation, commercial success, and mission infusion are selected. Figure 1 provides a visual representation and details the phase nature of the SBIR and STTR programs.

Phase I	Phase II	Phase III
• Provides the opportunity to establish the scientific, technical and commercial merit and feasibility of the proposed innovation in fulfillment of NASA needs • Awards of up to $125,000 • Period of performance for SBIR is 6 months. STTR contracts last up to 12 months.	• Focuses on the development, demonstration, and delivery of the proposed innovation • Includes only firms that have successfully completed Phase I • Awards of up to $750,000 •Period of performance is 24 months	• Moving innovative technologies, resulting from either a Phase I or Phase II contract, towards commercialization. • Funded from sources other than SBIR/STTR program and may be awarded with no further competition

Figure 1 - SBIR and STTR Program Phases

13 NASA's SBIR and STTR programs are SBIR and STTR opportunities are operated pursuant to the Small Business Innovation Development Act of 1982, P.L. 97-219 (codified at 15 U.S.C. 638) as amended by the Small Business Innovation Research (SBIR) Program, Extension, P.L. 99-443 which extended the program through September 30, 1993. On October 28, 1992, through the Small Business Innovation Research and Development Act of 1992 (P.L. 102-564), Congress reauthorized and extended the SBIR Program for another seven years (2000). Subsequently, on December 21, 2000, through the Small Business Reauthorization Act of 2000 (P.L. 106-554) Congress again reauthorized the SBIR Program. With the approval of H.R. 2608, Continuing Appropriations Act 2012, the SBIR Program was authorized through December 31, 2011. On

Industry Description

NASA SBIR and STTR awards are given to small businesses who are classified under North American Industry Classification System (NAICS) industry 541712 [Research and development in the physical, engineering, and life sciences (except biotechnology)]. According to the U.S. Census bureau, companies represented by NAICS 541712 provide research and experimental development services in the physical, engineering, and life sciences, such as agriculture, electronics, environmental, biology, botany, computers, chemistry, food, fisheries, forests, geology, health, mathematics, medicine, oceanography, pharmacy, physics, veterinary and other allied subjects.

NAICS 541712 was created in 2007 in order to distinguish most scientific research and development from biotechnology research and experimental development, which remains classified under NAICS 541711. According to the 2007 U.S. Economic Census data, NAICS 541712 contains 7,831 firms nation-wide, which employ approximately 555,000 workers and generate over $71 billion in receipts and revenue annually. Figures 5 and 6 show the number of firms separated by employment size categories and revenue and receipts earned. A right skew to the histogram (figure 5) indicates that an inverse relationship exists between firm employment size and the number of firms, that is: the number of firms per category decreases as a firm's size increases. Over 92 percent of NAICS 541712 firms are small business with 499 employees or less; the histogram indicates that firms with less than five employees are the most common within the industry. However, the few large firms within the industry generate a disproportionate amount of the industry's revenues.

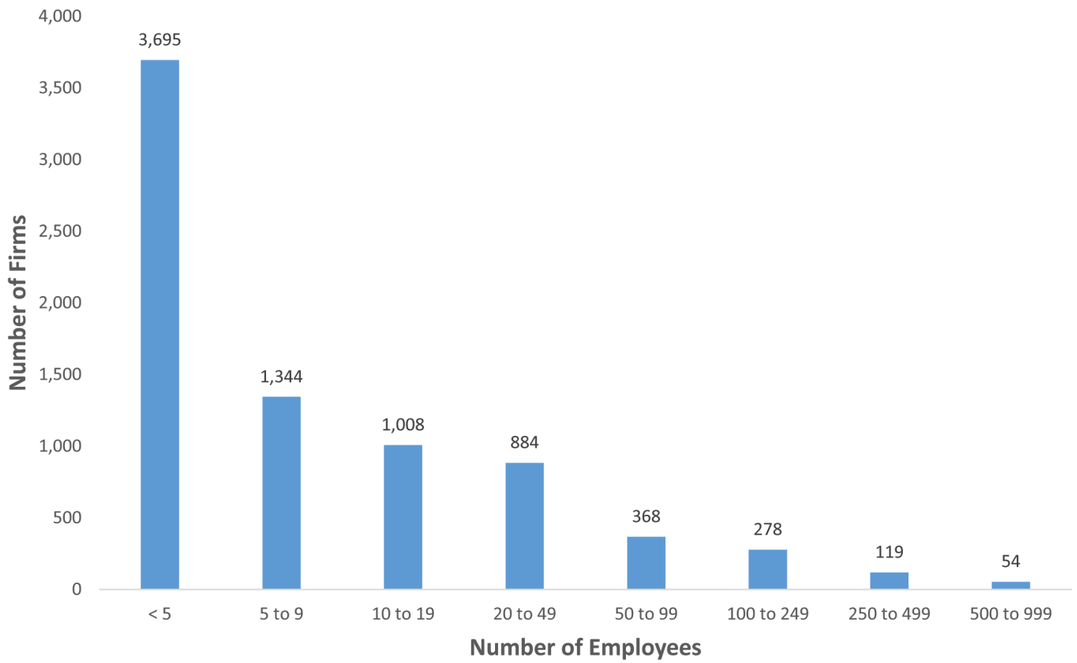


Figure 2 - NAICS 541712 Firms by Employment Size

Introduction

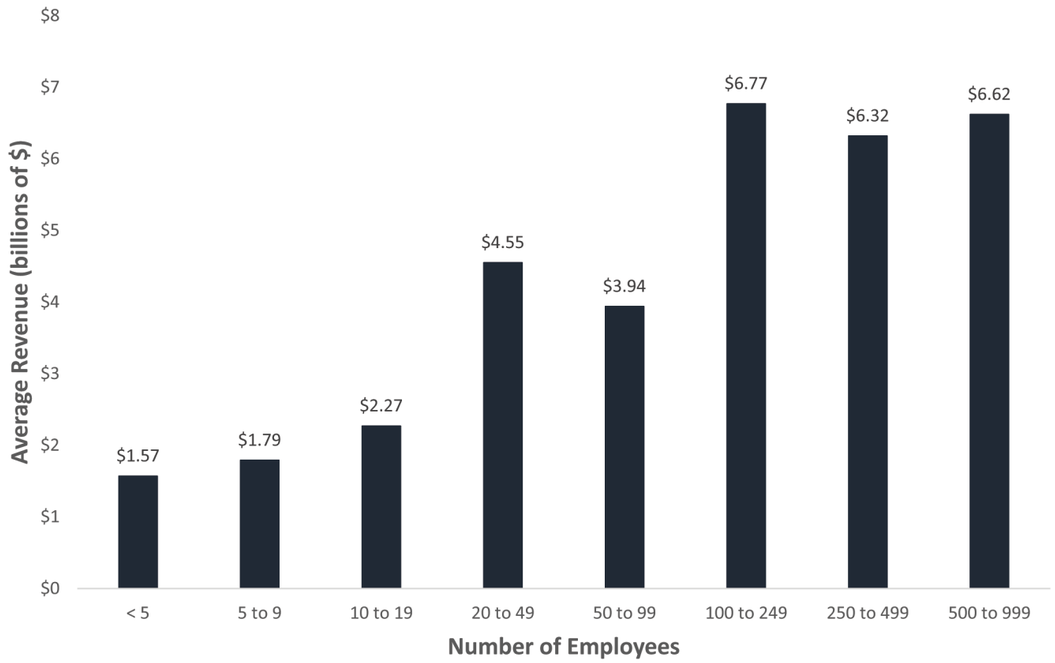


Figure 3 - NAICS 541712 Firms Receipts and Revenues by Size

2015 SBIR Program Selection and Award Description

In Fiscal Year 2015, NASA funded 325 Phase I awards at $125,000 each and 119 Phase II awards at $750,000 each.

Table 3- Number of FY2015 SBIR Awards

FY2015 Quantity of SBIR Phase I and Phase II Awards	
Quantity of FY2015 Phase II SBIRS	119
Quantity of FY2015 Phase I SBIRS	325

Figure 4 represents the number of award dollars that the SBIR program invested in each state through Phase I and II awards in 2015. NASA's SBIR and STTR programs routinely analyze and seek to serve underrepresented states and as a result of the programs' efforts, small businesses from 39 (including D.C.) states received at least one new SBIR award in FY2015. Total investment in each of these states ranges from approximately $125,000 to over $6 million.

The figure indicates that coastal states and states containing the largest economies received a larger portion of SBIR funding than states concentrated in middle of the country with smaller economies. Historically as well as in the 2015 fiscal year, the States of California, Colorado, Connecticut, Maryland, Massachusetts, Texas, and Virginia are well represented in the program. Both Massachusetts and California received over $6 million from NASA's SBIR Program.

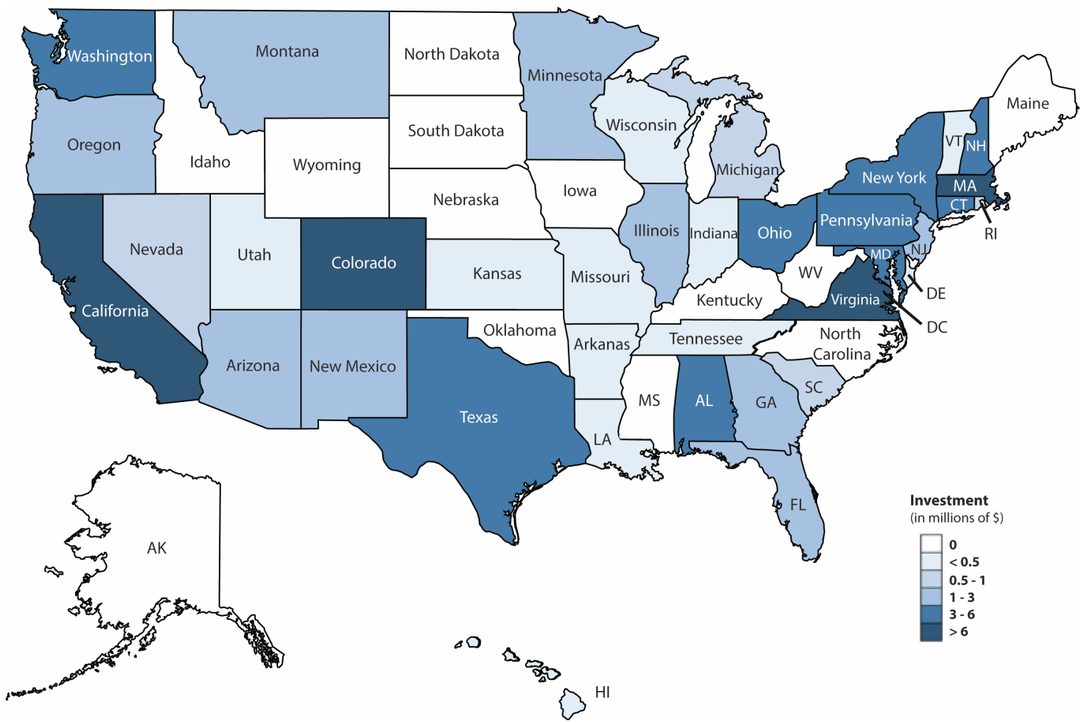


Figure 4 - Spatial Distribution of SBIR Award Dollars by State [FY2015]

FY2015 SBIR and STTR Awards

2015 STTR Program Selection and Award Description

In Fiscal Year 2015, NASA funded 32 STTR Phase I awards at $125,000 each and 21 Phase II awards at $750,000 each.

Table 4 - Number of FY2015 STTR Awards

FY2015 Quantity of STTR Phase I and Phase II Awards	
Quantity of FY2015 Phase II STTRS	21
Quantity of FY2015 Phase I STTRS	32

The STTR program awarded 10 states new Phase I and/or Phase II awards. Once again, California received the largest portion of the STTR program's award budget. Many mid-western states did not receive an STTR award in FY2015. Figure 5 further indicates that coastal states with large economies tend to outperform the rest of the country in both the SBIR and STTR programs. The high level of participation of firms from a handful of states appears to be due to the large number of quality universities within the awarded states, as well as their highly technical and diversified economies.

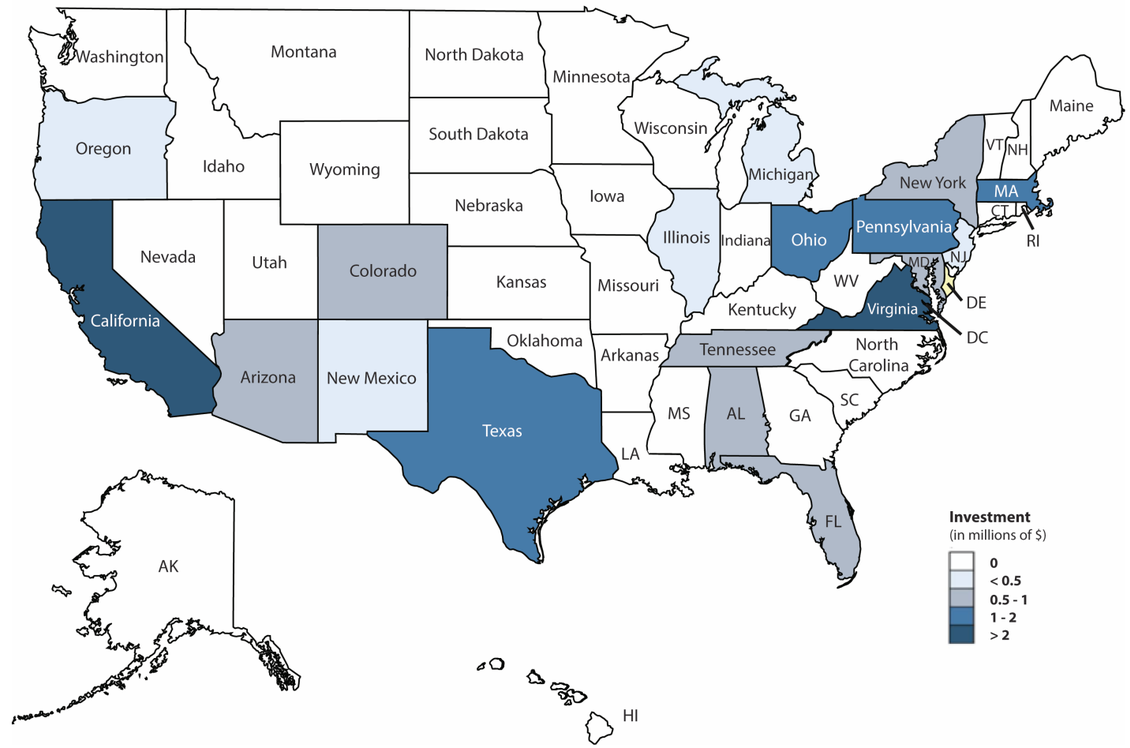


Figure 5 - Spatial Distribution of STTR Award Dollars by State [FY2015]

Scope of Work

NASA SBIR and STTR awards have a broad national economic impact that is not simply limited to the States that received funding. While an analysis of only the states receiving awards would provide an insight into a portion of the economic impacts of the programs, the resulting analysis would underestimate the total national effects of the program. This is due to the fact that many firms purchase goods and services from suppliers in other states, including states where no SBIR or STTR awards are made.

As an example, an analysis focusing on the state-wide economic impact of an award given to a Texas firm for creation of novel space communication antenna would only estimate the indirect and induced impacts of good and services purchased within the State of Texas. This analysis would not take into account the complete economic impacts of the project if some portion of the project was supplied with goods and services from outside the region (such as testing equipment purchased from a firm in the State of Arkansas). Therefore, the economic impacts of the NASA SBIR and STTR programs are reported at the national level.

Estimated Employment

SBIR and STTR research and development activities across the United States have generated or retained significant employment across a variety of economic industries in fiscal year 2015. As detailed in Table 5 – National Employment Impacts below, it is estimated that 2,582 jobs were created or retained by the SBIR and STTR programs in FY2015. These 2,582 jobs can be further parsed into three groups:

1. direct jobs —jobs projected to take place at the participating SBCs—totaling 759;
2. indirect jobs —jobs created by suppliers of goods and services to the SBC—totaling 754; and
3. induced jobs — jobs created by increases in consumer spending totaling 1,071.

2,582 Jobs Created/Retained

Given the original investment and the resulting estimate job count, the results of the analysis indicate that NASA's SBIR and STTR programs create one job for every approximate $69,933[14] of funding.

Table 5- National Employment Impacts

Employment Effect	SBIR	STTR	CRP	Combined
Direct Effect	639	93	27	759
Indirect Effect	635	92	27	754
Induced Effect	902	131	38	1,071
Total Effect	2,175	316	91	2,582

Estimated Output (Gross Domestic Product)

It is estimated that the NASA SBIR and STTR programs have a significant annual effect on U.S. economic output in fiscal year 2015. NASA's SBIR program investment added approximately $399.64 million to the nation's economic output, also known as gross domestic product (GDP). The substantially smaller STTR program created approximately $58.11 million in economic output.

14 This value delineates the amount of funds required to create one direct, indirect, or induced job. The financial equivalent of a direct job with the Scientific Research and Development NAICS (541712) is approximately $128,682.68.

In total, NASA $180.57 million investment and resulting economic activities added an estimated $474.46 million to the nation's economic output, a return of approximately $2.69 for every dollar spent in awards (Table 6).

$474.46 Million in Economic Output & $2.69 Return for Every Dollar Spent in Awards

Table 6- National Output Impact

National Output	SBIR	STTR	CRP	Combined
Economic Output ($Millions)	$399.64	$58.11	$16.71	$474.46

Labor Income

The SBIR and STTR programs also have a positive effect upon workers' earnings in the national economy. Labor income is the sum of both employee compensation and proprietor income. The SBIR and STTR program combine to increase wages, income, and earnings by over $172.10 million nationally. Table 7 displays the direct, indirect, and induced labor income effects of both the combined SBIR and STTR programs.

Table 7 - National Labor Income Impact

Employment Effect	SBIR	STTR	CRP	Combined
Direct Effect ($Millions)	$60.38	$8.78	$2.53	$71.69
Indirect Effect ($Millions)	$39.33	$5.72	$1.64	$46.69
Induced Effect ($Millions)	$45.25	$6.58	$1.89	$53.72
Total Effect ($Millions)	$144.96	$21.08	$6.06	$172.10

Gross vs. Net Economic Impacts The magnitude of the economic impact of a publically funded program, Depends upon the industry of investment and the magnitude of investment (amongst others). The measurable impacts can be reported in gross or net terms. Gross economic impacts take into account economic effects that are created by a project or program. Due to the dynamic nature of economics, simply providing gross effects can overstate the economic value of a project of program. Net economics impacts are those which incorporate offsetting effects such as displaced demand, lower household income, or lower household investment.

If gross impacts are those which are created without any consideration of whether they increase or impair spending elsewhere, than net impacts are those which attempt to capture, quantify, and incorporate these offsetting effects. As an example, consider a high-end luxury developer who plans to demolish an old grocery store in order to build a fine-dining restaurant in its place. The resulting development would create 20 restaurant jobs as well as terminate 100 grocery store jobs. The gross impact of the restaurant development would be 20 jobs. But because the destruction of the grocery store eliminates 100 jobs, the net impact would be negative 80 jobs (20 jobs created - 100 jobs lost = -80 jobs).

When determining the net economic effect of a public policy or public program requiring government funds, a similar paradigm is employed. One must consider that taxes need to be levied upon American households and businesses in order to fund the public programs and services. These levied taxes are household funds that would otherwise be used in private consumption or investment. As an example, supposed a city raises $850 million dollars in taxes to construct a new football stadium. The stadium creates 1,000 jobs while the same $850 million in private consumption and investment would only create 900 jobs. The net effect of the stadium development would be a mere 100 jobs (1,000 jobs created by the stadium- 900 jobs which would have been created in the absence of construction = 100 jobs). Conversely if, if the stadium created less jobs than other would have been created by private consumption, the stadium would have a net negative economic impact.

Gross Job Impacts

Regarding gross job impacts, our analysis concludes:

- FY2015 national SBIR and STTR investments into scientific and research and development industries was approximately $180.57 million.
- The programs' combined investment led to the creation of approximately 807 jobs directly in scientific research and development and approximately a combined approximately 2,582 jobs throughout the American economy in total.
- The job creation estimates only calculate jobs stemming from both programs' research and development efforts and do not estimate jobs emanating from the administration and management of the program.

Net Job Impacts

According to the data reported to the U.S. Small Business Administration (SBA) NASA's FY2015 investment into research and development companies was approximately $180.57 million.

- The programs' diversion from private consumption and investment actually increased net employment by over 300 jobs.
- NASA SBIR and STTR programs created over $100 million in economic output that would not have been created if the programs did not exist and funds were simply left "in people's pockets".
- Without taking into account ancillary impacts (such as the advancement of new technologies and the creation of active marketplace businesses) the economic impact of the program is net-positive when compared to the control state.

Table 8 - Net Job Impacts

National Output	Column A	Column B	Column C
	Gross Investment	Gross Non-Investment	Net Investment
Employment	2,582	2,203	379
Output ($Millions)	$474.46	$365.83	$108.63

Implications

The analysis suggests that the NASA SBIR and STTR programs create more jobs than would otherwise be created if the program funding raised from taxes was left with households and businesses to spend on private consumption and investment activities. In other words, the programs have a positive economic net impact, not simply a positive gross economic impact. This is because investment into research and development technologies requires input from a broad-band of industries and typically creates well-paying jobs. This dispersion of capital into productive industries allows these effects to circulate and perpetuate through the economy multiple times through high impact industry.

Economic and Fiscal Impact

Conversely, the median American household's top three purchases occur in three industries which either contain low-paying jobs or have very small multiplier effects, such as: (1) Food services and drinking places; (2) Real estate establishments; and (3) Private hospitals. The implication of the analysis is that, while consumer choice is often important feature of any market-driven economy, it also pays to facilitate small businesses - particularly in high value-added industries - like those focused on research and development of technologies.

Industry Sectors

The total economic impact of NASA SBIR and STTR investment takes place across various national industries by means of indirect and induced economic effects. Table 9 displays the 10 most impacted industries (by employment) due to NASA SBIR and STTR investment.

Most of the impacts occur in the scientific research and development services, because the industry impacts reflect the nature of the NASA's investment. However, service industries, real estate, and healthcare industries also received a share of the economic benefits from NASA's initial investment.

Table 9 - Top 10 Impacted Industries (Based Upon Employment Impacts)

IMPLAN Sector	Description	Employment	Labor Income ($Millions)	Value Added ($Millions)	Output ($Millions)
456	Scientific research and development services	807.5	$77.8	$98.5	$192.3
440	Real estate	161.9	$3.2	$23.7	$30.3
464	Employment services	116.3	$4.1	$5.0	$6.1
454	Management consulting services	86.9	$7.8	$7.9	$12.7
447	Legal services	68.6	$6.0	$9.3	$12.7
501	Full-service restaurants	58.9	$1.4	$1.6	$3.1
502	Limited-service restaurants	48.4	$1.2	$1.8	$2.9
482	Hospitals	45.3	$3.5	$3.9	$6.9
449	Architectural, engineering, and related services	44.5	$3.8	$3.3	$6.0
395	Wholesale trade	39.5	$3.4	$6.4	$9.3

*Please note that the values in the figure should be interpreted as illustrative of industry effects rather than precise given model and data limitations.

Economic and Fiscal Impact

Estimated Tax Revenues

The economic activity derived from NASA SBIR and STTR's investment creates a substantial fiscal impact upon both federal and local governments. Table 10 shows the estimated total federal taxes generated by participating small businesses.

Table 10- Estimated Federal Tax Revenue

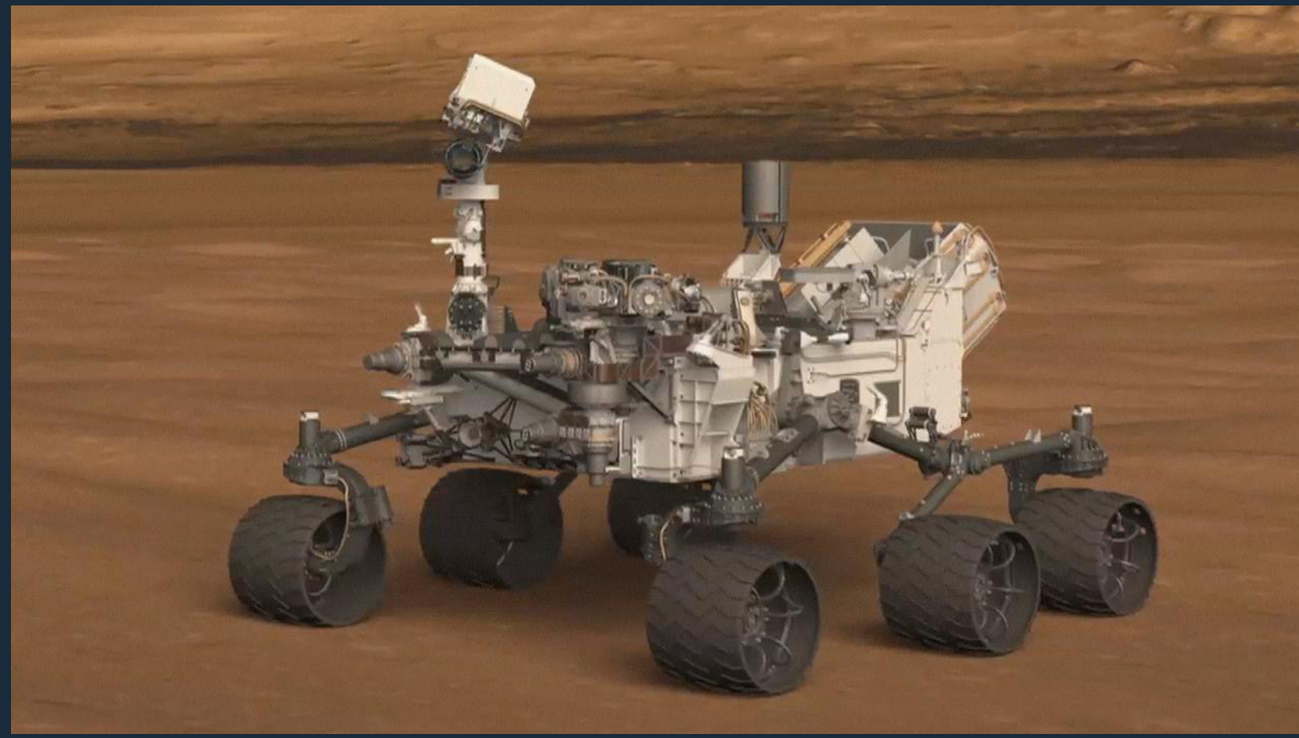
Tax Type	Revenues Generated ($Millions)
Social Insurance	$18.51
Personal income taxes	$13.28
Corporate profits taxes	$5.74
Fees and other federal payments	$0.48
Excise taxes	$0.92
Total federal taxes	$38.93

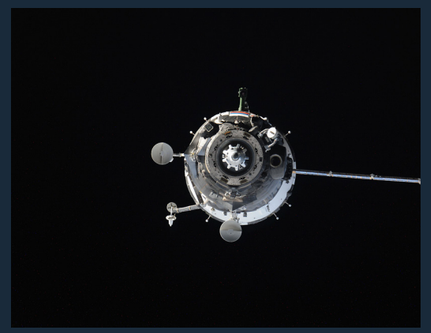
Table 11 displays the estimated total state and local taxes generated by participating SBIR programs. Sales and income taxes comprise approximately half of the estimated total tax revenues, with fees, fines, and other taxes constituting the majority of the remainder.

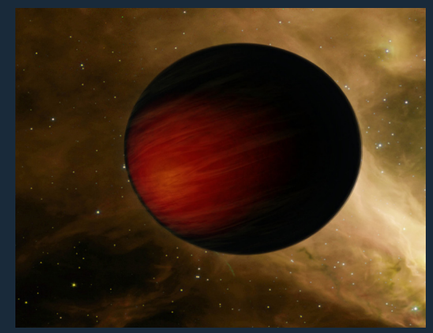
Table 11- Estimated State and Local Tax Revenue

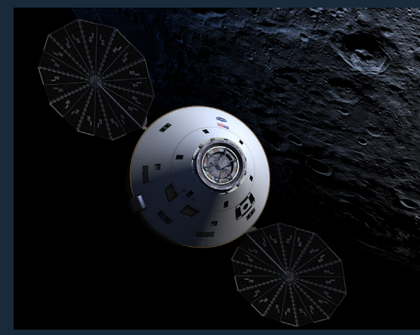
Tax Type	Revenues Generated ($Millions)
Property taxes	$0.08
Sales taxes	$5.42
Income taxes	$3.54
Social Insurance	$0.30
Fees, fines, and other taxes	$7.72
Total state and local taxes	$17.04

The $180.57 million direct divesture by NASA to the SBCs via the SBIR program and the subsequent economic output of $474.46 million, while only a fraction in terms of national GDP, has significant economic importance. The economic impact of government sponsored research and development programs cannot and should not be understated entirely within their directly measurable effects on the economy due to the nature of research and development. The NASA SBIR and STTR programs have and will continue to serve as a successful platform in maintaining and promoting economic activities between the Federal Government and SBCs, as well as driving technology and innovation.w









California Economic Impact Report

The National Aeronautics and Space Administration's (NASA) Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) awards have significantly affected the U.S. economy on a national and state level. This section will focus on SBIR/STTR awards for California within last five fiscal years. Within this time period, the programs have contributed $170.35 million ($151.43 million from the SBIR program and $18.92 from STTR) to the state's economy.

The total dollar value for all California SBIR/STTR awards has continuously increased for the last three fiscal years. The sudden drop in funding for FY2012 is attributed to the government's enforcement of sequestration.

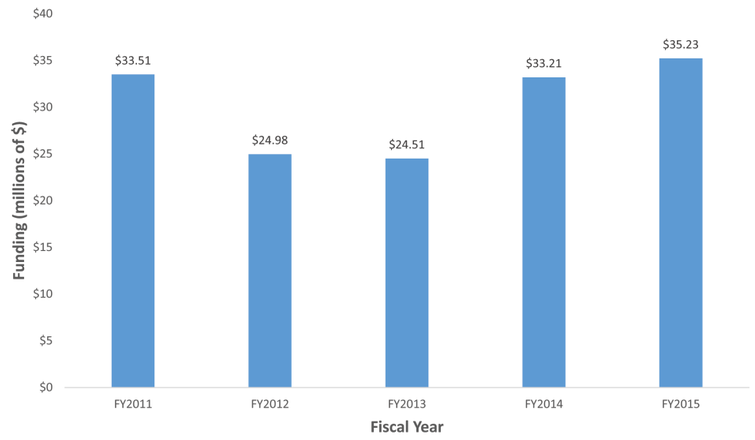


Figure A.1 – SBIR California Total Investment by Fiscal Year

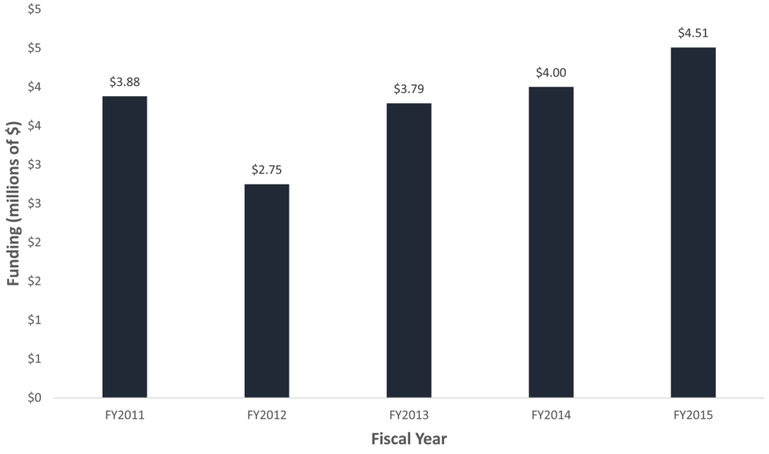


Figure A.2 – STTR California Total Investment by Fiscal Year

Appendix

From FY2011 to FY2015, only 19 countries from California received NASA SBIR/STTR award dollars. The counties that received the largest investments include Los Angeles ($52.84 million), Santa Clara ($27.43 million), and San Diego ($21.01 million). Silicon Valley and Southern California received the majority of SBIR and STTR investments for California.

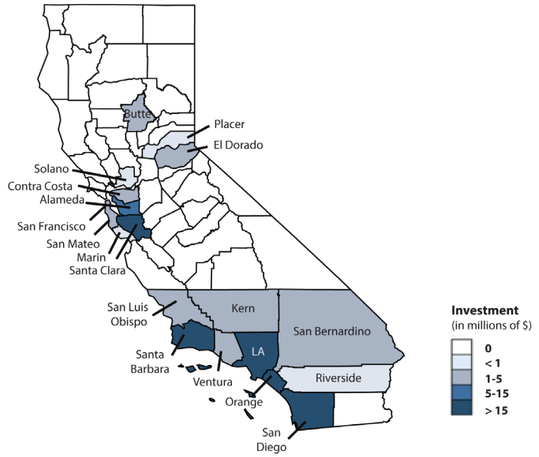


Figure A.3 – SBIR/STTR California Investment by County

California SBIR/STTR Awards

The results of economic impact for California will focus on the FY2015 NASA SBIR/STTR obligated funds. The programs awarded California firms $39.74 million ($35.23 million in SBIR and $4.51 million in STTR) in Phase I and Phase II contracts.

$39.74 Million Invested in FY2015

California Economic and Fiscal Impact

Economic and Employment Impacts

Table A.1 shows the direct, indirect, and induced statewide impacts from the SBIR and STTR funds invested in California. The SBIR and STTR programs account for significant level of economic activity in the state, the programs generated $82.69 million in economic activity and supported 378 jobs.

$82.69 Million in Economic Output & Supported 378 Jobs

Table A.1 Economic and Employment Impacts for California

Impact Type	Employment	Output ($Millions)
Direct Effect	118	$39.74
Indirect Effect	117	$19.80
Induced Effect	143	$23.15
Total Effect	378	$82.69

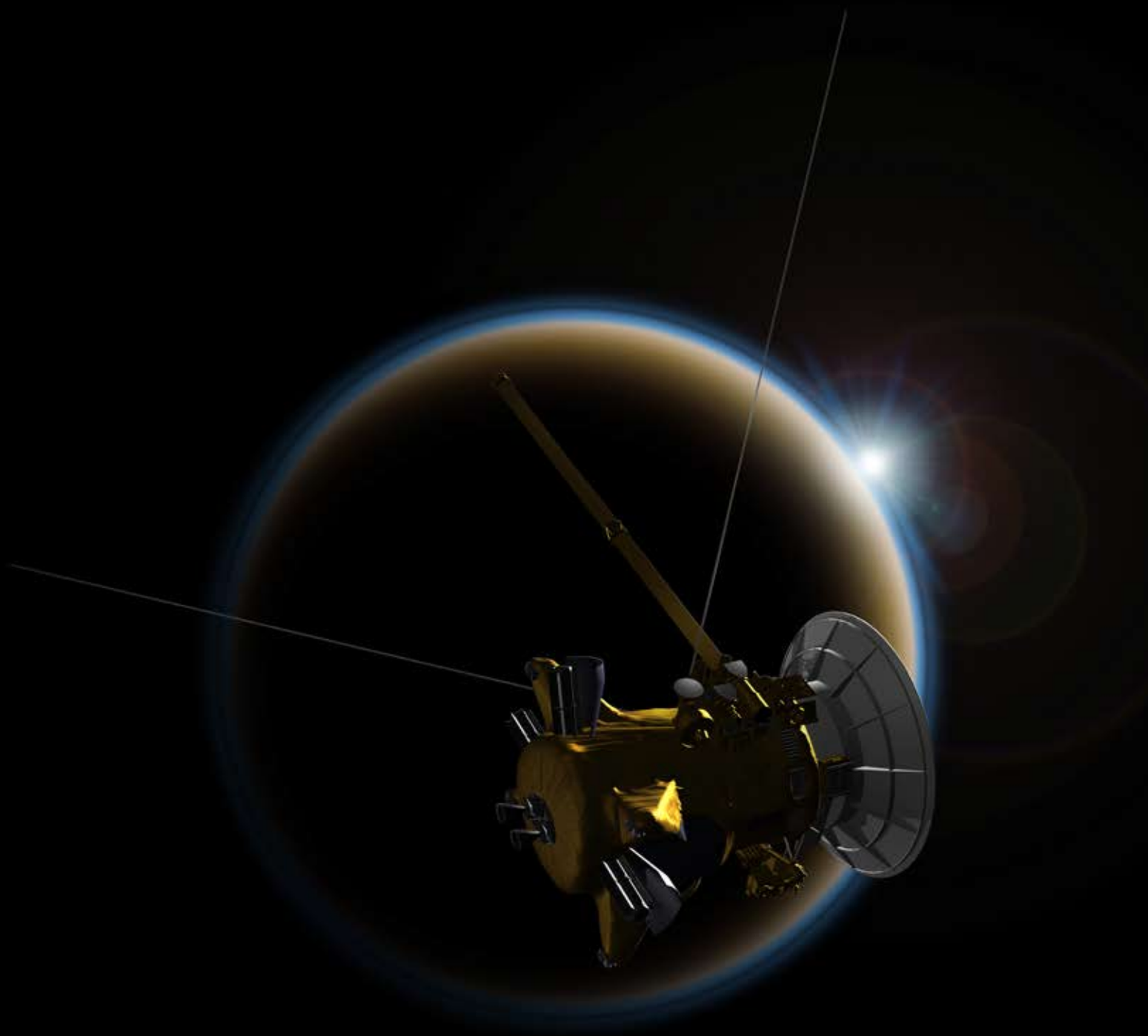
Tax Impacts

The economic activity from the SBIR and STTR funds for California firms resulted in approximately $3.21 million in total state and local taxes, this total is capture in Table A.2

Appendix

Table A.2 Tax Impacts for California

Tax Recipient/Tax Category	California Total
Corporate Profits Tax	$183,116
Dividends	$9,441
Personal Tax: Income Tax	$1,032,165
Personal Tax: Motor Vehicle License	$38,507
Personal Tax: NonTaxes (Fines- Fees	$183,405
Personal Tax: Other Tax (Fish/Hunt)	$8,953
Personal Tax: Property Taxes	$13,084
Social Ins Tax- Employee Contribution	$31,771
Social Ins Tax- Employer Contribution	$62,053
Tax on Production and Imports: Motor Vehicle Lic	$19,200
Tax on Production and Imports: Other Taxes	$125,898
Tax on Production and Imports: Property Tax	$685,666
Tax on Production and Imports: S/L NonTaxes	$21,807
Tax on Production and Imports: Sales Tax	$802,041
Tax on Production and Imports: Severance Tax	$451
Total State and Local Tax	$3,217,559



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